Diptera General 1.

pam
QX505
1913
A93h

ISH MUSEUM (NATURAL HISTORY)

ECONOMIC SERIES No. 1

THE HOUSE-FLY AS A DANGER TO HEALTH

ITS LIFE-HISTORY AND HOW TO DEAL WITH IT

BY

ERNEST E. AUSTEN

ASSISTANT IN THE DEPARTMENT OF ENTOMOLOGY
BRITISH MUSEUM (NATURAL HISTORY)

SECOND EDITION

B. M.
(N.H.)

LONDON
PRINTED BY ORDER OF THE TRUSTEES
OF THE BRITISH MUSEUM
1913

[PRICE ONE PENNY]

22500312872

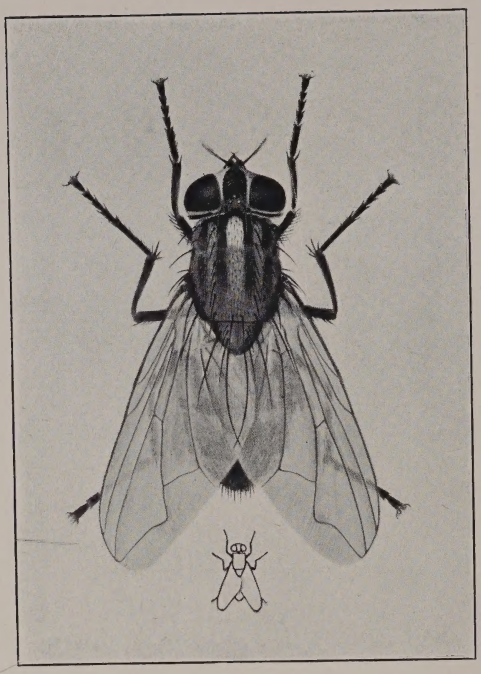

FIG. 1.

FIG. 2.

FIG. 1. THE HOUSE-FLY (female).
FIG. 2. THE LESSER HOUSE-FLY (male).

Both figures six times the natural size, which is indicated in each case by the outline drawing below.

BRITISH MUSEUM (NATURAL HISTORY)
ECONOMIC SERIES, No. 1

THE HOUSE-FLY AS A DANGER TO HEALTH

ITS LIFE-HISTORY AND HOW TO DEAL WITH IT

BY

ERNEST E. AUSTEN

ASSISTANT IN THE DEPARTMENT OF ENTOMOLOGY
BRITISH MUSEUM (NATURAL HISTORY)

SECOND EDITION

LONDON

PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM

SOLD AT

THE BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, S.W.
AND BY
B. QUARITCH, 11, GRAFTON STREET, NEW BOND STREET, W.
AND DULAU & CO., LTD., 37, SOHO SQUARE, W.

1913

All rights reserved

WELLCOME INSTITUTE LIBRARY
Coll. welMOmec
Coll. pam
No. QX 505
1913
A93h

THE HOUSE-FLY.*

(*Musca domestica*, L.)—Fig. 1.

This familiar but often dangerous little creature, to which the Swedish naturalist Linnæus gave the name *Musca domestica* in 1761, is one of the most widely distributed of all insects, since, owing to its close association with and dependence upon man, it has been carried about the world in ships and trains, and is now found practically everywhere. Possessing in a remarkable degree the power of adapting itself to its surroundings, it flourishes in the Tropics equally as well as in temperate regions.

The House-Fly is usually about a quarter of an inch in length, and is mouse-grey in colour, with the thorax (middle part of the body) marked with four narrow black stripes, and the sides of the abdomen (hinder part of the body) more or less buff in the male, and frequently in the female also. In the male House-Fly the space between the eyes, as seen from above, is scarcely one-fifth of the total width of the head, but in the female the corresponding space is broader and occupies nearly one-third of the diameter of the head. The proboscis, or tube through which the insect sucks up its food, ends in a pair of fleshy lobes, and when not in use is folded away into a cavity on the under side of the head. Lastly, it may be noted that one of the long veins (the so-called *fourth longitudinal vein*) in each wing is, near the tip of the wing, sharply elbowed in such a way that the end of this vein almost meets that of the vein in front of it (*see* Fig. 1).

* Enlarged models (28 times natural size) of the House-Fly, and of its eggs, maggot or larva, and pupa (puparium) or chrysalis are exhibited in the Central Hall of the British Museum (Natural History).

In the British Islands, in addition to the true House-Fly, certain other species of flies more or less resembling it in general appearance often occur in the living-rooms of houses: these are the Lesser House-Fly (*Fannia canicularis*, L., Fig. 2, a smaller and more slenderly built insect,* with a silvery-white face in the male sex, and without a conspicuously *elbowed* vein near the tip of each wing—compare Figs. 1 and 2—which makes its appearance somewhat earlier in the year, and may still be seen in living-rooms so late as November, when the true House-Fly has usually disappeared), *Muscina stabulans*, Fln., and *Stomoxys calcitrans*, L.† The latter of these—a species often met with even in the centres of large towns, though commoner in the suburbs and found almost everywhere in the country—is a blood-sucking fly which is sometimes mistaken for *Musca domestica*, with the result that the House-Fly is occasionally alleged to have inflicted a bite, although its proboscis is merely adapted for sucking and is quite incapable of piercing the skin.

Though agreeing with the House-Fly in length, *Stomoxys calcitrans* is of a somewhat broader and more thick-set shape, and may readily be distinguished from *Musca domestica* by the character of its proboscis, which is rigid and slender, and is *always visible*, projecting like an awl horizontally in front of the head. In colour, *Stomoxys calcitrans* is darkish grey, and its abdomen, which has no buff-coloured patches on the sides, is

---

* Specimens of *Fannia canicularis* and other small flies occasionally met with in houses are sometimes supposed by those who are not entomologists to be "young" House-Flies. It may therefore be worth while to repeat that, as has often been stated before, *House-Flies*, like other insects in the same stage, *do not grow*. Growth, after the insect leaves the egg, is confined to the larval or maggot-stage, and the House-Fly on passing from the chrysalis-stage to that of the adult emerges from its pupa-case fully grown. When therefore small flies resembling House-Flies are seen in houses, they are *not* "young" House-Flies, but either belong to a distinct species, or are undersized House-Flies which will never become any larger, their diminutive dimensions being due to unfavourable conditions (generally insufficiency of food or too great dryness of the food-material) during the larval stage.

† The Blow-Fly or Bluebottle (*Calliphora erythrocephala*, Mg.) is not referred to here, since it is quite different from the House-Fly in appearance and size and its general characteristics are familiar to everyone.

spotted with dark brown; the fourth longitudinal vein in the wing of this fly, although somewhat bent up at the end, is not sharply elbowed as in the House-Fly, and consequently its termination is distinctly separated from that of the preceding vein.

Muscina stabulans is, as a rule, of larger dimensions than any of the flies already mentioned, and its length often considerably exceeds a quarter of an inch. Its general coloration is dark grey, and its abdomen is without definite spots. The extreme tip of the middle part of the body and a portion of each leg are more or less distinctly tinged with cinnamon colour; the proboscis when not in use is invisible from above; and in the wing the end of the fourth longitudinal vein is not elbowed, and converges but slightly towards that of the vein before it.

Breeding-Places and Life-History. As a general rule accumulations of fermenting horse-manure form the chief breeding-places of the House-Fly, but although this insect lays its eggs by preference in horse-manure, it will also breed in other excrementitious substances, and in decaying and fermenting organic matter of various kinds, such as is often present in ashpits and larger deposits of house-refuse. The dull, chalky-white eggs are about $\frac{1}{25}$th to $\frac{1}{20}$th of an inch in length, and are laid in small masses (*see* Fig. 3), generally in crevices in the material that is to supply the maggots (or larvæ) with food. A single female House-Fly lays from 120 to 150 eggs at one time, and may deposit five or six such batches of eggs during its life. The rate of development varies greatly, depending upon several factors such as the temperature of the food-material and of the air, and the character of the food; in the British Islands, however, it has been found that in very hot weather the progeny of a House-Fly may be laying eggs about three weeks after the eggs from which they themselves developed were deposited. The eggs hatch into white, footless maggots (Figs. 4, 6, and 7), which when full-grown are a little under half an inch in length; the chrysalis- or pupal stage is passed within a dark reddish-brown, barrel-shaped puparium or shell (Fig. 5), from which the fly emerges by splitting off a cap at one end.

In winter the persistence of the species is apparently secured by the survival, in bake-houses, kitchens, stables, and other suitable retreats, of flies which are the parents of the earliest broods of the following season. In the British Islands these latter usually commence to make their appearance in June, though as a rule it is not until the following month that the numbers of flies begin to show a marked increase. Generally speaking, in the absence of local conditions specially favourable to the breeding of the insects in abnormal numbers at an earlier period than usual (as at Post-

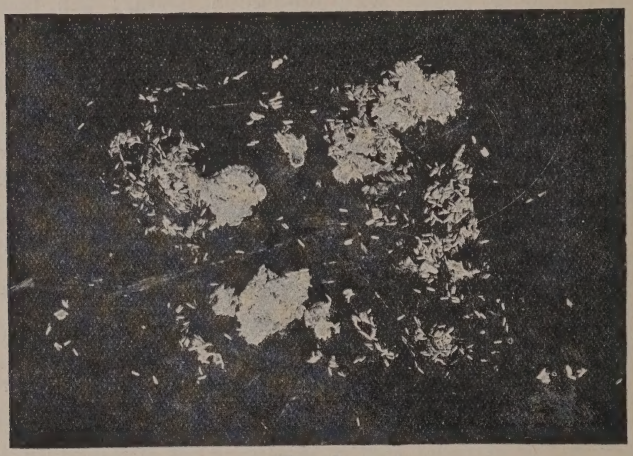

FIG. 3.

BATCHES OF HOUSE-FLY EGGS IN STABLE MANURE (natural size).
Total number of eggs about 1,500.
From a photograph by Professor Robert Newstead, F.R.S., kindly lent by the Health Committee of the City of Liverpool.

wick, near Norwich, in June and July, 1910), House-Flies in the United Kingdom are most numerous in the months of August and September, but they are often still common in October, and sometimes even in November. The occasional local occurrence of House-Flies in such numbers as to constitute a veritable "plague" is generally traceable to one or more of the following factors:—(1) Exceptional meteorological conditions favouring abnormally rapid development; (2) the local abundance of breeding-places and of food-supplies for the maggots or larvae; (3) the presence, in

the immediate vicinity, of a "tip" or dumping-ground for dust-bin refuse, on which, with the refuse, are continually being deposited

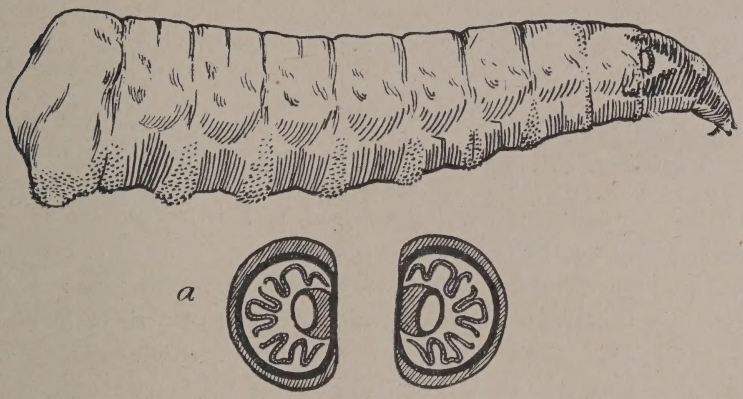

FIG. 4.

FULL-GROWN HOUSE-FLY MAGGOT, OR LARVA (about nine times natural size).

a, the two plates on the hinder extremity of the maggot, through which the creature breathes (greatly enlarged).

The anterior extremity of the maggot is to the right, the broader end being the posterior one. The maggot crawls, with its narrower end in front, by the aid of a hook (shown in the figure), which is protruded from the mouth, and a series of spiny pads on the under surface of the body. The mouth is situated on the under side, just behind the narrow end, and the maggot, like the parent Fly, feeds upon fluids.

The larvae or maggots of a very large number of other flies are similar in appearance to those of the House-Fly, which, however, can be distinguished from most other larvae by the deeply folded shape of the three air-clefts in the posterior breathing-plates (*a*).

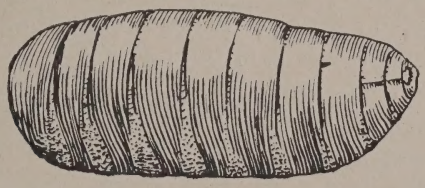

FIG. 5.

HOUSE-FLY PUPARIUM OR CHRYSALIS-CASE (about eight and a half times natural size).

As in all species of flies belonging to the same natural group as the House-Fly, the puparium is formed from the contracted and hardened skin of the full-grown larva, which serves as a case to contain the pupa or chrysalis. The fly when ready to emerge makes its escape by forcing off a cap from the anterior end (to the right in the figure) of the puparium.

large numbers of larvae and pupae, which have developed from eggs originally laid in a number of different centres.

Large numbers of House-Flies are destroyed every autumn by

a parasitic fungus (*Empusa muscae*, Cohn), which is the most effective natural enemy of *Musca domestica;* flies killed in this way may often be seen clinging to window-panes and walls, attached to the supporting surface by outgrowths (rhizoids) from the fungus itself.

House-Flies and Disease. Since the House-Fly breeds, as we have seen, in dung-hills and refuse-heaps, and during its adult life alights and feeds indiscriminately upon human excreta as well as upon human food, it is obvious that grave results may ensue when House-Flies and certain forms of disease exist together. Much has been written in recent years with reference to House-Flies and the spreading of various human diseases of bacterial origin, and, although the experimental evidence is as yet incomplete, there can be no doubt that, under certain conditions, these insects act as carriers of cholera, typhoid fever, and tropical dysentery, while in connection with other maladies, such as infantile or summer diarrhœa, the House-Fly at present rests under grave suspicion. Since this fly is incapable of biting, its action as a disease-carrier is contaminative, and therefore very different from that of an African Tsetse-Fly or a malaria-carrying Mosquito, which is armed with a piercing proboscis. The germs of disease, if conveyed by a House-Fly, are carried on the exterior of its legs, wings, head or body, or, as is more usually the case, in the insect's crop or intestine, and may subsequently be deposited on food or other substances. House-Flies therefore become a serious menace to health when liable to contamination with disease-causing organisms, and should consequently be regarded as *dangerous enemies*, which should be destroyed and kept in check by every possible means.

Remedies and Preventive Measures. The potentialities of the House-Fly as a disease-disseminator in the poorer quarters of cities and in farmhouses and rural districts generally, quite apart from the annoyance and discomfort caused by its activities, especially when it is present in excessive numbers, render *Musca domestica* by far the most important of British

FIG. 6.

FIG. 7.

FIG. 6. A MASS OF HOUSE-FLY MAGGOTS IN STABLE MANURE (natural size).
FIG. 7. THE SAME MAGGOTS SEPARATED FROM THE MANURE.

From photographs by Professor Robert Newstead, F.R.S., kindly lent by the Health Committee of the City of Liverpool.

insects from the standpoint of public hygiene. Under modern conditions House-Flies, except as "danger signals," serve no purpose useful to ourselves; while, as just pointed out, they may at any time develop into a danger to human life, so that no one need have the slightest compunction in killing them. Obviously, however, it is of more importance to **prevent House-Flies from breeding,** than, after allowing them to breed unchecked, to endeavour to kill the resultant broods when they have invaded houses.

Temporary accumulations of horse-manure should if possible be stored in fly-proof bins,* while kitchen refuse should be deposited in completely closed receptacles, into which it should be impossible for flies to crawl. House-Fly maggots, like many other Dipterous larvae, are tenacious of life, and although they can be killed, at any rate experimentally, by mixing with the manure or garbage in which they are feeding substances such as chloride of lime or sulphate of iron in solution, there are various practical difficulties in the way of such methods. In practice, therefore, the most important and effective means of preventing House-Flies from breeding is the systematic removal, during the months from May to October inclusive, of all deposits of stable-manure and household dustbin or ashpit refuse *at least once a week.* Since, as has recently been shown, House-Flies are capable of flying to a distance of 1,700 yards,† no municipal depot, contractor's dumping ground

---

* A *fly-proof bin* for the temporary storage of horse-manure is best constructed of concrete, so as to ensure that the interior is perfectly smooth. It should be provided on the top with a closely fitting hinged lid, and on one side with a similarly constructed hinged door, of the full width or length of the bin, to facilitate the removal of the manure. In the case of a stable occupied by a single horse, an ordinary galvanised iron "sanitary" dustbin, of suitable dimensions and provided with a tightly fitting lid, may be sufficient.

† *See* "An Experimental Investigation on the Range of Flight of Flies." By S. Monckton Copeman, M.D., F.R.S.; F. M. Howlett, B.A., F.E.S., Second Imperial Entomologist to the Government of India; and Gordon Merriman, Student in Medical Entomology, Quick Laboratory, Cambridge (Reports to the Local Government Board on Public Health and Medical Subjects. (New Series, No. 53.) Further Reports (No. 4) on Flies as Carriers of Infection, p. 8. London: Published by His Majesty's Stationery Office. 1911.)

or "tip," where household refuse is allowed to remain for any length of time, should, if any other arrangement is possible, be established or permitted to exist within one mile and a half of the nearest habitations.

In military standing camps, where in hot or warm weather there is always a danger that House-Flies may be bred in large numbers unless the methods of modern military sanitation be rigidly enforced, epidemics of typhoid fever may readily be caused owing to the joint presence of House-Flies and human typhoid "carriers." Some form of incinerator should always be used for the destruction of stable-litter and other refuse, as well as of human excreta, which may contain the typhoid fever organism (*Bacillus typhosus*), and in the latrines, whether trenches or pails be employed, some system of fly-proof covers should be adopted. If the provision of such covers be rejected as impracticable, it rests with the responsible authority to ensure that earth is not only provided in sufficient quantity, but used in such a way as to render it impossible for flies to become contaminated.

Of the various means of destroying House-Flies in rooms, those commonly in use are too well known to require mention. Flies on the wing may readily be knocked down and killed by means of a kind of racquet of flexible wire-gauze (known as a "fly-killer"), provided with a wooden handle, and obtainable from ironmongers. The best ready-made fly-traps, other than ordinary fly-papers, are probably the "balloons" constructed of wire gauze, and "tangle-foot" tapes or other contrivances coated with a sticky gum. Good results are said to have been obtained by the use of a dilution of formalin in water, in the proportion of a teaspoonful of formalin to a teacupful of water. To make it more attractive to flies, the dilution may be sweetened with sugar or mixed with milk, and a soup-plate or other shallow vessel should then be partially filled with the mixture in the evening, and allowed to stand through the night on a table in a room in which flies are troublesome. Provided that all other liquids from which the insects could drink have been removed or securely covered, the flies will sip the mixture in the early morning, and a

little later may be swept up dead a short distance away. Formalin diluted to the extent mentioned is not dangerous to man, and this method may be used without hesitation even where food is exposed.

It is said that paraffin, if rubbed on the sashes and bars of the window, will kill all the flies in a room; this method at any rate possesses the merits of simplicity and cheapness.

So far as possible, human food—especially such substances as cooked meat and milk and sugar, which are especially attractive to these insects—should always be protected from flies by covers of wire-gauze or muslin, and House-Flies should not be allowed to settle upon persons suffering from infectious or contagious diseases. Rigorous precautions should, of course, be taken to prevent House-Flies from coming into contact with the sputa of consumptives, or with the evacuations from cases of cholera, typhoid fever, summer diarrhœa and other intestinal disorders. **No system of sanitary control can be regarded as efficient which allows flies to have access to material containing the germs of disease.**

Condensed Bibliography. For the benefit of those who may desire fuller information concerning the House-Fly, its metamorphoses, anatomy and relation to disease, the following *Condensed Bibliography* is appended.

(1) Reports to the Local Government Board on Public Health and Medical Subjects (New Series, Nos. 5, 16, 40, 53 and 66). Preliminary, Further Preliminary, and Further Reports on Flies as Carriers of Infection, 1909–1912. (Papers, tables, illustrations, abstracts from literature, and bibliographies by various writers dealing with "Flies as Carriers of Infection." Price respectively 2*d.*, 3*d.*, 9*d.*, 4*d.* and 3*d.*) London: printed for, or published by His Majesty's Stationery Office, and obtainable through any bookseller.

(2) The House-Fly, *Musca domestica*, Linnaeus. A Study of its Structure, Development, Bionomics and Economy. By

C. Gordon Hewitt, D.Sc. 8vo., pp. xiii, 195. Ten Plates. (Manchester: at the University Press, 1910.) Price 20*s.* net.

(3) The House-Fly, Disease Carrier. An Account of its Dangerous Activities, and of the Means of Destroying It. By L. O. Howard, Ph. D. 8vo., pp. xix, 312. Frontispiece and forty other illustrations. (New York: Frederick A. Stokes Company, 1911.) Price 1 dollar 60 cents net.—Republished in England, 1912. (London: John Murray, Albemarle Street, W.) Price 6*s.*

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
DUKE STREET, STAMFORD STREET, S.E., AND GREAT WINDMILL STREET, W.

BRITISH MUSEUM

(NATURAL HISTORY).

DAYS AND HOURS OF ADMISSION.

The Exhibition Galleries are open to the Public, free daily—

on WEEK-DAYS, throughout the year from 10 A.M., in

January	to	4	P.M.
February 1st to 14th	„	4.30	„
„ 15th to end	„	5	„
March	„	5.30	„
April to August (inclusive) ...	„	6	„
September	„	5.30	„
October	„	5	„
November and December ...	„	4	„

on MONDAYS and SATURDAYS, from the beginning of May to the middle of July, to 8 P.M., and from the middle of July to the end of August, to 7 P.M.;

on SUNDAYS, in

January	from	2	to	4	P.M.
February 1st to 14th ...	„	2	„	4.30	„
„ 15th to end ...	„	2	„	5	„
March	„	2	„	5.30	„
April	„	2	„	6	„
May to August (inclusive)	„	2.30	„	7	„
September	„	2	„	5.30	„
October	„	2	„	5	„
November and December	„	2	„	4	„

The Museum is closed on Good Friday and Christmas Day.

By Order of the Trustees,

L. FLETCHER,

Director.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LTD., DUKE STREET, STAMFORD STREET, S.E.